CLAIMS

What is claimed is:

Claim 1. A multi-phase fuel system for use with an internal combustion engine for providing a combination of gaseous vaporized high volatility components of gasoline and atomized liquid lower volatility components of gasoline to said engine based on engine demands, comprising:

a fuel source which exists in a liquid state at normal atmospheric pressure and temperature;

a fuel delivery means in fluid communication with said fuel source for delivering said liquid fuel from said fuel source to said multi-phase fuel system;

a separator means for heating said liquid fuel and supplying a mixture of vaporized lower boiling temperature components of said liquid fuel and atomized higher boiling temperature components of said liquid fuel to said engine, said separator means in fluid communication with said fuel source;

an on-board computer for monitoring fuel requirements as a function of engine demand, said on-board computer in operational control of said fuel delivery means.

Claim 2. The multi-phase fuel system as set forth in claim 1, wherein said multi-phase fuel system includes an air-gas mixing device;

wherein said air-gas mixing device utilizes intake manifold pressure of said engine to control the amount of said

vaporized low boiling components of fuel and said atomized high boiling components of fuel introduced into the airstream entering said engine.

Claim 3. The multi-phase fuel system as set forth in claim 2, wherein said air-gas mixing device includes a plunger valve;

wherein said plunger valve closes to substantially reduce the amount of residual vaporized and atomized fuel contained within said separator means from escaping therefrom.

Claim 4. The multi-phase fuel system as set forth in claim 1, including a liquid fuel regulating means for regulating said liquid fuel supplied to said multi-phase fuel system by said fuel delivery means.

Claim 5. The multi-phase fuel system as set forth in claim 4, wherein said liquid fuel regulating means includes a pressure regulator for regulating the pressure of said liquid fuel supplied to said fuel delivery means.

Claim 6. The multi-phase fuel system as set forth in claim 5, wherein said pressure regulator utilizes engine manifold vacuum to regulate the pressure of said liquid fuel supplied to said multi-phase fuel system by said fuel delivery means.

Claim 7. The multi-phase fuel system as set forth in claim 4, wherein said liquid fuel regulating means includes a liquid fuel flow regulator.

Claim 8. The multi-phase fuel system as set forth in claim 7, wherein said liquid fuel flow regulator is operatively controlled by said on board computer.

Claim 9. The multi-phase fuel system as set forth in claim 1, wherein said separator means includes:

a canister, said canister having an internal bore, a fresh air inlet aperture and an air-fuel mixture outlet aperture;

at least one heating element means for supplying heat to said canister bore, said heating element means being removably attached to said canister;

at least one fuel modulating means for controlling liquid fuel admitted into said canister bore, said fuel modulating means constructed and arranged for removable attachment to said canister, said fuel modulating means in electrical communication and operatively controlled by said on-board computer.

Claim 10. The multi-phase fuel system as set forth in claim 9, wherein said heating element means is in electrical

communication and operatively controlled by at least one electrical switch;

Claim 11. The multi-phase fuel system as set forth in claim 9, wherein said heating element means is in electrical communication and operatively controlled by said on board computer.

Claim 12. The multi-phase fuel system as set forth in claim 9, wherein said heating element means for supplying heat to said vaporizing chamber comprises at least one electrical glow plug.

Claim 13. The multi-phase fuel system as set forth in claim 9, wherein said heating element means includes at least one resistor, said at least one resistor constructed and arranged to operatively control the temperature of said heating element means.

Claim 14. The multi-phase fuel system as set forth in claim 9, wherein said heating element means includes at least one rectifier bridge, said at least one rectifier bridge constructed and arranged to operatively control the temperature of said heating element means.

Claim 15. The multi-phase fuel system as set forth in claim 9, wherein said canister bore includes at least one sensor for monitoring temperature within said canister bore, said sensor being removably attached to said canister, said sensor being in electrical communication with said on-board computer;

wherein said on board computer utilizes said sensor to operatively control said heating elements means to regulate temperature within said canister bore.

Claim 16. The multi-phase fuel system as set forth in claim 9, wherein said fuel modulating means for controlling liquid fuel admitted into said canister bore comprises at least one fuel injector, said fuel injector in electrical communication and operatively controlled with said on-board computer.

Claim 17. The multi-phase fuel system as set forth in claim 16, wherein said fuel injector produces a superfine atomized spray when said fuel injector is actuated by said on-board computer.

Claim 18. The multi-phase fuel system as set forth in claim 9, wherein said canister fresh air inlet includes at

least one air inlet control means for allowing fresh air to enter said canister.

Claim 19. The multi-phase fuel system as set forth in claim 18, wherein said at least one air inlet control means is a check valve whereby said at least one check valve opens to allow fresh air to enter said canister bore when the pressure differential across said check-valve is sufficient and said check valve closes said fresh air inlet aperture to prevent said air/fuel mixture from flowing out of said canister when said pressure differential across said check valve is insufficient.

Claim 20. The multi-phase fuel system as set forth in claim 19, wherein said check valve requires at least about one half pound of pressure differential to open and allow said fresh air to enter said canister.

Claim 21. The multi-phase fuel system as set forth in claim 19, wherein said check valve includes at least one aperture which is at least about one sixteenth of an inch in diameter.

Claim 22. The multi-phase fuel system as set forth in claim 9, wherein said canister bore includes at least one insulating layer for preventing the loss of internal heat.

Claim 23. A multi-phase fuel system kit for use with an internal combustion engine, said engine having a liquid fuel system including a fuel source which exists in a liquid state at normal atmospheric pressure and temperature and a fuel delivery means in fluid communication with said fuel source for delivering said liquid fuel from said fuel source to said liquid fuel system, wherein said fuel system kit provides a combination of vaporized high volatility components of gasoline and atomized lower volatility components of gasoline to said engine based on engine demands, comprising:

a diverter valve means for diverting said liquid fuel from said liquid fuel system to said multi-phase fuel system;

a separator means for supplying a mixture of vaporized lower temperature boiling components of fuel and atomized higher temperature boiling components of gasoline to said engine, said separator means in fluid communication with said fuel source;

wherein said internal combustion engine includes an on-board computer for monitoring fuel requirements as a function of engine demand, said on-board computer in operational control of said separator means.

Claim 24. The multi-phase fuel system kit as set forth in claim 23 wherein said multi-phase fuel system kit includes an air-gas mixing device;

wherein said air-gas mixing device utilizes intake manifold pressure of said engine to control the amount of said vaporized low boiling components of fuel and said atomized high boiling components of fuel introduced into the airstream entering said engine.

Claim 25. The multi-phase fuel system kit as set forth in claim 23 including a liquid fuel regulating means for regulating said liquid fuel supplied to said multi-phase fuel system by said fuel delivery means.

Claim 26. The multi-phase fuel system kit as set forth in claim 25, wherein said liquid fuel regulating means includes a pressure regulator for regulating the pressure of said liquid fuel supplied to said multi-phase fuel system.

Claim 27. The multi-phase fuel system kit as set forth in claim 26, wherein said pressure regulator utilizes engine manifold vacuum to regulate the pressure of said liquid fuel supplied to said multi-phase fuel system by said fuel delivery means.

Claim 28. The multi-phase fuel system kit as set forth in claim 23, wherein said liquid fuel regulating means includes a liquid fuel flow regulator.

Claim 29. The multi-phase fuel system kit as set forth in claim 28, wherein said liquid fuel flow regulator is operatively controlled by said on board computer.

Claim 30 The multi-phase fuel system kit as set forth in claim 23, wherein said means for supplying a mixture of vaporized low boiling components of fuel and atomized high boiling components of fuel comprises:

a canister, said canister having an internal bore, a fresh air inlet aperture and an air-fuel mixture outlet aperture;

at least one heating element means for supplying heat to said canister bore, said heating element means being removably attached to said canister;

at least one fuel modulating means for controlling liquid fuel admitted into said canister bore, said fuel modulating means constructed and arranged for removable attachment to said canister, said fuel modulating means in electrical communication and operatively controlled by said on-board computer.

Claim 31 The multi-phase fuel system kit as set forth in claim 30, wherein said heating element means is in electrical communication and operatively controlled by at least one electrical switch.

Claim 32. The multi-phase fuel system kit as set forth in claim 31, wherein said heating element means is in electrical communication and operatively controlled by said on board computer.

Claim 33. The multi-phase fuel system kit as set forth in claim 30, wherein said heating element means for supplying heat to said canister bore includes at least one electrical glow plug.

Claim 34. The multi-phase fuel system kit as set forth in claim 30, wherein said heating element means includes at least one resistor, said at least one resistor constructed and arranged to operatively control the temperature of said heating element means.

Claim 35. The multi-phase fuel system kit as set forth in claim 30, wherein said heating element means includes at least one rectifier bridge, said at least one rectifier bridge

constructed and arranged to operatively control the temperature of said heating element means.

Claim 36. The multi-phase fuel system kit as set forth in claim 30, wherein said canister bore includes at least one sensor for monitoring temperature within said canister bore, said sensor being removably attached to said canister, said sensor being in electrical communication with said on-board computer;

wherein said on board computer utilizes said sensor to operatively control said heating elements means to regulate temperature within said canister bore.

Claim 37. The multi-phase fuel system kit as set forth in claim 30, wherein said fuel modulating means for controlling liquid fuel admitted into said canister bore comprises at least one fuel injector, said fuel injector in electrical communication and operatively controlled with said on-board computer.

Claim 38. The multi-phase fuel system kit as set forth in claim 37, wherein said fuel injector produces a superfine atomized spray when said fuel injector is actuated by said on-board computer.

Claim 39. The multi-phase fuel system kit as set forth in claim 30, wherein said canister fresh air inlet includes at least one air inlet control means for allowing fresh air to enter said canister.

Claim 40. The multi-phase fuel system as set forth in claim 39, wherein said at least one air inlet control means is a check valve whereby said at least one check valve opens to allow fresh air to enter said canister bore when the pressure differential across said check-valve is sufficient and said check valve closes said fresh air inlet aperture to prevent said air/fuel mixture from flowing out of said canister when said pressure differential across said check valve is insufficient.

Claim 41. The multi-phase fuel system as set forth in claim 40, wherein said check valve requires at least about one half pound of pressure differential to open and allow said fresh air to enter said canister.

Claim 42. The multi-phase fuel system as set forth in claim 40, wherein said check valve includes at least one aperture which is at least one sixteenth of an inch in diameter.

Claim 43. The multi-phase fuel system as set forth in claim 30, wherein said vaporizing chamber includes at least one insulating layer for preventing the loss of internal heat.

Claim 44. A method as practiced on an internal combustion engine for supplying the components of a liquid fuel to said engine in at least two different phases to enhance combustion and reduce emissions comprising;

supplying said liquid fuel to a fuel regulating means;

atomizing said liquid fuel, whereby said atomized liquid fuel is directed across at least one heating element means;

heating said atomized liquid fuel, whereby said at least one heating element means is maintained at a predetermined temperature for vaporizing the higher volatility components of said atomized liquid fuel;

mixing said vaporized higher volatility fuel components and said atomized lower volatility fuel components with fresh air;

supplying said multi-phase fuel/air mixture to incoming air entering said engine for combustion as required by engine demands.

Claim 45. The method of claim 44 wherein said atomizing step includes at least one electric fuel injector operatively positioned so as to cause said liquid fuel to be injected as a

fine atomized mist and advance across said at least one heating element.

Claim 46. The method of claim 45 wherein said electric fuel injector is operatively controlled to inject said liquid fuel in response to engine demands sensed by an on-board computer.

Claim 47. The method of claim 44 wherein said heating step includes at least one electric heating element operatively controlled to maintain a predetermined temperature.

Claim 48. The method of claim 47 wherein said at least one heating element is operatively controlled to raise the temperature of said atomized liquid fuel to about 250° F.

Claim 49. The method of claim 47 wherein said at least one electric heating element is a glow plug.